SP-E1.6 Feather River Flow-Stage Model Development

October 25, 2002

1.0 Introduction/Background

Information on the Feather River stage at various locations and flow rates is important for a number of purposes such as floodplain, fisheries habitat, and riparian habitat analysis. Since much of these types of analysis have been performed along the Feather River there is a body of knowledge already available for use in this process. However since the riverbed is continually changing, which impacts the flow-stage relationships, additional information, especially if any channel modifications are considered, may be required. Developing this information will require the use of some sort of flow-stage modeling.

2.0 Study Objective

The goal of this study plan is to develop flow-stage model of the Feather River downstream of the diversion dam to its confluence with the Sacramento River for use in defining the flow-stage relationships at various points along the river.

3.0 Relationship to Relicensing /Need for the Study

The relicensing process requires analysis of potential impacts from a wide range of operational alternatives. Many of the impacts are directly related to the stage of the Feather River downstream of the diversion dam to its confluence with the Sacramento River. The model developed as a result of this study will be used to convert existing and/or simulated flow data to stage data for use in the required analysis.

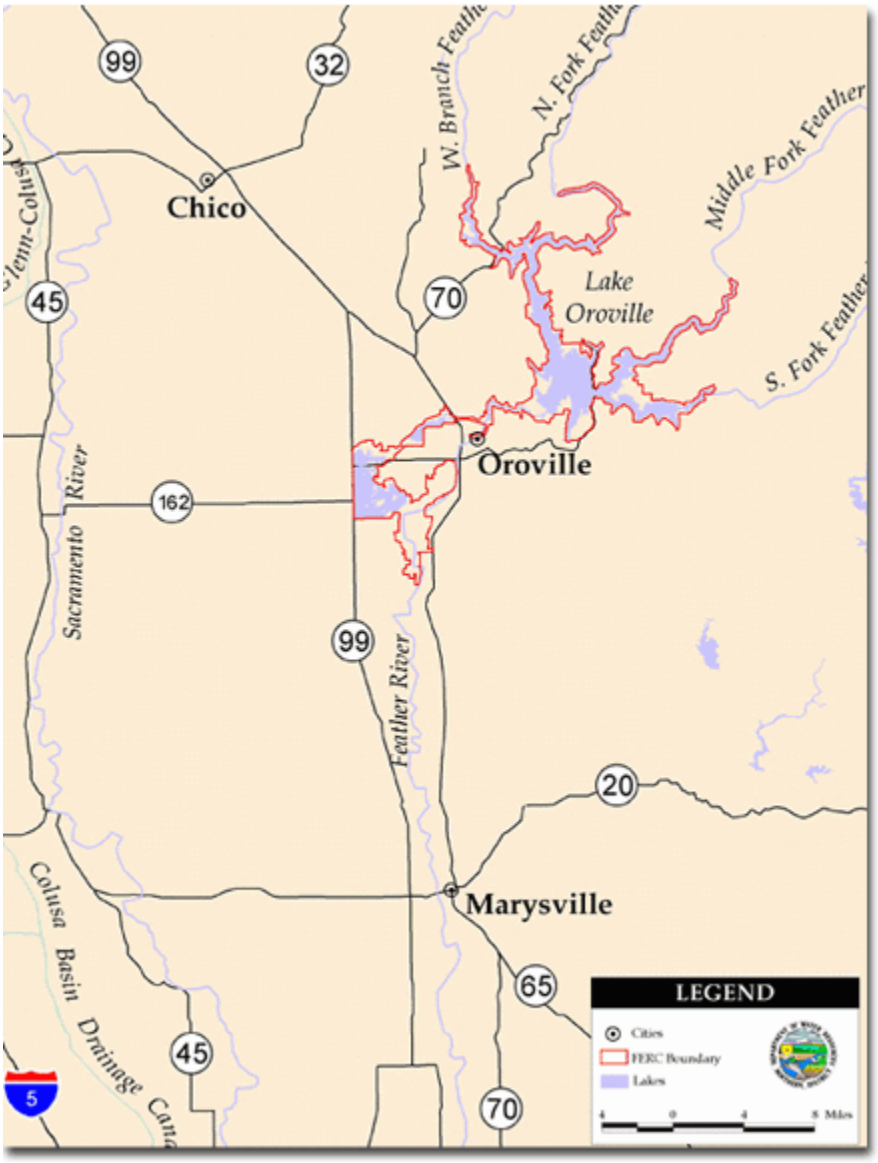
Information on flow-stage relationships is required so that flows can be converted to river stage to be used in further analysis such as riparian habitat availability, areas subject to overflow, etc. The flow-stage information is unique to the physical channel configuration and needs to be re-computed for alternatives where channel modifications are proposed.

The following Issue Statements will be addressed by this study:

- E6—effect of ramping rates on downstream facilities, power generation, water supply, water temperatures, and fish.
- E7—effect of the project including discharge (magnitude, frequency and timing) and ramping rates and the altered stream hydrology on substrate scour, mobilization of sediments, turbidity levels, and riparian vegetation in the low flow reach and downstream of the Afterbay.

4.0 Study Area

The study area includes the Feather River downstream of the diversion dam to its confluence with the Sacramento River. The scope does not include the area above the diversion dam due to minor water level fluctuations corresponding to major flow changes from Oroville Reservoir releases. Geographic scope may be refined as additional information is developed and needs are identified through collaboration with other Work Groups.



5.0 General Approach

This study will evaluate existing models and modeling tools that could be used to develop a flow- stage model of the Feather River downstream of the diversion dam to its confluence with the Sacramento River.

Task 1—Define Desired Outputs from the Model

As currently formulated the required products from this model are flow - stage relationships at various points in the Feather River downstream of the diversion dam to its confluence with the Sacramento River under all channel configurations proposed in the alternatives.

Task 2—Review Existing Models

At this time no existing models have been identified; however it is very likely that some can be found. The Feather River downstream of the diversion dam to its confluence with the Sacramento River has had extensive flood control and floodplain analysis in the past by the California Department of Water Resources (DWR) and other agencies. The most recent is the United States Army Corps of Engineers' (USACE's) Comprehensive Flood Control Study that includes the Lower Feather River. This work will need to be reviewed to identify any modeling that may have been performed in the past.

Task 3—Review Existing Data

Types of needed data includes:

- Existing flow-stage relationships
- Channel cross sectional data
- Channel roughness data

During the search for existing models performed under Task 2 existing data will also be identified. Other potential sources of exiting data such as USGS gauging station rating curves will be examined as sources of existing data.

Task 4—Review Modeling Tools

There are a number of modeling tools that may be appropriate for use to build the Feather River flow stage model. The existing modeling tools include the following:

- USACE developed HEC-2
- USACE developed HEC-RAS
- PHABSIM (Waddle 2001)—this model may be used for habitat evaluation and has a hydraulic component for flow-stage computation. PHABSIM is part of the In-stream Flow Incremental Methodology (IFIM) developed by the United States Fish and Wildlife Service (USFWS). PHABSIM consists of a set of 1-D hydraulic simulation programs linked to a set of habitat simulation programs for streams.

Each of these tools, and possibly others, will be evaluated for suitability to meet the needs identified in Task 1.

Task 5—Select Appropriate Model or Modeling Tool

Based on the results of Tasks 1 through 4 select the appropriate model/modeling tool to create the Feather River Flow-Stage Model for this process. The work group will approve the model/modeling tool selection.

Task 6—Collect Field Data for Development/Calibration/Verification

Each model or modeling tool requires specific data for development/calibration/verification purposes. Once the model or modeling tool has been selected the specific data required to perform these tasks can be identified and compared to all known existing data to see if additional data is required to complete the model development.

Subtasks for this include:

- Identify additional data required
- Install instrumentation as required
- Collect data

Task 7—Complete Model Development/Calibration/Verification

Develop flow-stage model if required. The model should be developed to adequately characterize the variable river morphology and bed geometry (if not already) so fluctuating flow conditions can be described.

Subtasks include:

- Develop physical system definition in model
- Calibrate model
- Verify completed model

Task 8—Integrate Completed Model into Model Development Scheme

Integration of the model into the model development scheme will require development of the transfer utilities defined in Study E1. These transfer utilities will be used for three main purposes:

- Extract data from the central modeling database, modify this data as required for input to the Feather River flow stage model;
- Extract data from the Feather River flow stage model output files, perform any computation on them that may be required and store the results in the central modeling database; and
- Allow review of all data being transferred for quality control purposes.

Task 9—Perform Benchmark Simulations

Perform initial benchmark studies of stage at varying flows at various points at desired locations with the existing channel geometry.

6.0 Results and Products/Deliverables

Results

This study plan will result in a Feather River flow-stage model and benchmark studies with the existing channel configuration for use in the process.

Products/Deliverables

There will be two products of this study plan:

- A flow-stage model of the Feather River downstream of the diversion dam to its confluence with the Sacramento River calibrated on the existing channel configurations. This product will be fully integrated into the overall modeling scheme.
- Existing channel flow-stage relationships at varying locations.

7.0 Coordination and Implementation Strategy

Coordination with Other Resource Areas/Studies

Tasks performed for this study will be coordinated with Study Plan #1—Model Development. Its development will also be coordinated with study plans from other work groups that will require flow-stage data.

8.0 Schedule

This section to be developed.

9.0 References

Waddle, T.J. October 2001. PHABSIM for Windows README.